Eggs

by

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Eggs.

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Eggs.

In our study of biological subjects we have become familiar with cells of various shapes and sizes - both of animal and of vegetable organisms; but few of us think of the eggs of our common barnyard fowls as being merely a simple reproductive cell which may or may not have been fertilized.

The egg cell of the hen with its simple nucleus remains a simple cell though its yellow yolk substance may increase to many times its original size. As soon as the egg is fertilized it assumes a different form. It then becomes the many celled yolk that we eat.

In the ripe egg cell from the ovary of the hen, the yellow nutritive yolk is composed of many concentric strata and is surrounded by a thin yolk membrane. The nucleus cell-kernel or germ-vesicle lies in the upper part, where it has been forced by the amount of food taken in through the yolk membrane, and is embedded in a substance called the white egg-yolk. From this small mass of white egg-yolk at the surface of the yolk, a small neck reaches down to the center of the yolk where it forms a small ball.

After the ripe egg has left the ovary and has been fertilized in the oviduct it becomes surrounded by various coverings which are secreted by the oviduct. First a thick layer of albumen forms around the yolk. Then the outer calcarious shell with its thin lining of skin is formed. These covering are of no importance to the development of the embryo.

When the egg shell is opened and the yolk is taken out, a small circular white disc is found on the upper surface of the yolk. This disc is the cicatricula or tread in which the nucleus lies.

If the white of the egg be examined closely slender coiled filiments will be noticed. These have at one end been attached to the yolk and at the other to the inner lining of the shell and by this means the yolk has

been held suspended at or near the centre of the egg.

As an egg is an undeveloped or embryo chicken it must contain all the substances in proper proportions necessary to make all parts of a chicken, bones, feathers, blood and muscle. These parts can be made from the proteids and from the fats holding the necessary acids while the carbohydrates which furnish energy for motion are not needed as the little chicken can move about very little.

Eggs vary much in size, color and composition. As there is little difference in the food value of hens eggs and those of our other common fowls and they are more used in cooking, it is most convenient to use hens eggs in general experimental work. So in the rest of my discussion hens eggs are meant; when the term "eggs" is used.

The average weight of a hen's egg is 50 grams or 2 ounces.

The weight of shell = 12% = 6 gms.
White = 58% = 29 gms. } Hutchison.
Yolk = 30% = 15 gms.

Shell = 11%
White = 57% } Langworthy.
Yolk = 32%

It is usually considered that 8 or 9 eggs weigh a pound or that a dozen weighs about 1 1/2 pounds. Selling eggs by weight has been advocated both for securing equal values for the money spent and that the cooks may become used to recipes giving the weight of eggs required and thus secure more exact and satisfactory results.

The shell is mostly calcium carbonate and becomes thinner as the chicken inside developes but the lime in the shell is not used to form the bones of the chicken as the lime in the yolk and white supplies this.

The proteid of the white is almost pure albumen in solution. The albumen is enclosed in thin walled cells which are broken up when the white is beaten. This egg albumen is not a single substance but is made up of several proteids some of which are compound and contain a carbohydrate. As it is very difficult to tell when an albumen is pure, chemists can not find a satisfactory formula.

The following formulas for the white of egg have been given.

C 72 H 112 O 22 N 18 S.

C 234 H 322 O 66 N 52 S 2

C 240 H 392 O 75 N 65 S 3.

The proteids of the white include ovalbumen, the most important since it forms most of the egg white, ovomucin and ovimucoid, glycoproteids present in small quantities, and conalbumen, having the same chemical properties as ovalbumen. The phosphorus in the white is equivalent to about .03% phosphoric acid. The chief ash constituent is sodium chloride.

The yolk contains the food for the young chicken and contains less water and more solid matter than does the white. The yolk has a large percentage of fat in a condition of emulsion, being held in suspension by the vitellin.

The different constituents of the yolk are in the form of complex compounds the nature of which is not clearly understood. Osborne and Campbell found that the yolk contains a large amount of protein which resembles globulin, which is less soluble than albumen, but is believed to be a mixture of compounds of protein matter with lecithin.

The nuclein of the yolk is a proteid and is important because it contains phosphorus in organic combination and united with iron in a compound.

As has been said the fats Palmatin, Stearin and Olein, also found

in butter, are in the form of an emulsion.

Much of the food value of the yolk is due to the cholesterin, lecithin, glycerine and phosphoric acid it contains. These substances contain phosphorus in such a form that it can be easily absorbed by the body. Because of this they are often called phosphatides.

Cerebrin is a glucoside which is mostly found found in nervous tissue. Its nutritive value is not known.

The phosphoric acid, lime and iron areethe most important minerals contained. The phosphorus and the iron being almost all present as organic compounds and so readily enter into the circulation.

Milk is the only other food that contains proportionally as much calcium as does the yolk of an egg. As the lime is easily assimilated it is probably present in organic combination.

The sulphur in the egg causes the black stain noticed on silver forks after they have been used for eggs. Silver sulphide is formed.

The unpleasant odor of rotten eggs is due to the formation of hydrogen sulphur or sulphuretted hydrogen as it is sometimes called.

Langworthy gives as the compcsition of the edible portion of the egg:

	Water	Protein	Fat	Ash	Fuel value per lb.
Whole egg	73.7%	13.4%	10.5%	1	720.
White	86.2	12.3	.2	.6	250.
Yolk	49.5	15.7	33.3	1.1	1705.

Hutchison gives the following:

Whole egg	Edible portion	Moderately lean meat.
Shell 11.2%	Water 73.7	73.0
Water 65.5	Proteid14.8	21.0

	Edible portion	Moderately lean meat.
N. Matter 13.1	Fat 10.5	5.5
Fatty matter 9.3	Ash 1.0	1.0
Found in the Ash.	Yolk	White.
Potassium	9.29	31.41
Sodium	5.87	31.57.
Lime	13.04	2.38
Magnesium	2.13	2.79
Oxide of Iron	1.65	0.57
Phosphoric Acid	65.46	4.41
Sulphuric Acid		2.12
Fluorine	.86	1.06
Chlorine	1.95	28.82

Yolk (Detailed Analysis)

1 Water		51.8%
2 Proteids	vitellin	15.8
	nuclein	1.5
3 Fats	palmatin stearin olein	20.3
4	Cholesterin	.4
	Lecithin	7.2
	Glycerine. Phosphoric Acid	1.2
5 Cerebrin		0.3
6 Coloring matter		0.5
7 Mineral matter		1.0

The question of the preservation of eggs is an important one, since at certain seasons in the year the demand by far exceeds the supply while at other seasons the sonditions are reversed. In some localities the subply of fresh eggs is at all times less than the demand. In such places the eggs must come from perhaps long distances and even before being shipped have probably been kept for some time.

The main idea in storing eggs is that the air should be kept from them and the temperature be low.

The air should be kept from them so that evaporation of the water in in the shells shall be retarded and to keep bacteria from penetrating the egg. The temperature is kept low so that any bacteria that may be in the egg may not develope and cause the eggs to spoil.

Eggs are often packed in saw dust, bran, oats, ashes, ordinary road dust, etc. Almost anything of that sort will do only care must be taken that there is no odor about the material as the eggs rapidly absorb odors. Not only the flavor but also the keeping qualities will be injured by packing in musty straw or bran.

Great quantities of eggs are put into the ordinary egg cases without packing of any sort then kept in cold storage for months. These are spoken of as cold storage or refrigerator eggs and are sold as "cooking eggs".

Immersing eggs in lime water to which salt may or may not be added has been tried with a varying success. Often a solution of water glass (silicate of soda) to ten quarts of water, distilled water is to be preferred. The eggs are placed small end down in a tub or barrel and this solution poured over them. This method has been quite successful. The shells of the eggs are sometimes coated with vaseline, shellac or solution of glycerine and salycilic acid.

Of the different methods mentioned the immersion in the water glass solution is the best though it is said that the shells are apt to crack when boiled; it is suggested that in such cases the blunt end be punctured before boiling. But it must be remembered that to make any of these methods successful the eggs must be kept in a cool place and the vessels and material in which they are stored must be clean and odorless and the egg turned at intervals to prevent yolks from adhering to the side of the shell. Sometimes the eggs are removed from their shells, stored in bulk and kept at very low temperature - a little below freezing or they may be dried and sold as a powder.

There is no reason why refrigerator eggs, if properly cared for should not be wholesome and satisfactory for cooking purposes though some think they lack the delicate flavor of new laid eggs. Neither is there any thing to show that the lime or the water glass injures their nutritive value though it is sometimes believed to affect their flavor and make the white a little thinner though they still beat up well.

A housekeeper should be able to judge as to whether eggs are fresh or stale without first opening them and not wonder perhaps when she is "boiling" eggs for breakfast why a certain egg will presist in rising half out of the water.

As eggs grow old their density decreases through evaporation. A new laid egg placed in brine made in the proportion of 2 oz of salt to a pint of water should sink at once to the bottom and lie on the side. As the egg gets older it will tend to assume a more nearly vertical position in the water and will tend to rise to the surface.

Eggs are often tested by the "Candling" method that is they are held up against a light in a dark room. "The fresh egg appears unclouded

and almost translucent; if incubation has begun, a dark spot is visible which increases in size according to the length of time incubation has continued. A rotten egg appears dark colored. When an egg is very bad the contents can easily be shaken and it is more difficult to tell those that are not really very bad.

Fresh eggs look clear the shell looks clear and is usually somewhat rough while if the egg has been for any time under absitting hen the shell becomes dull looking, smooth and somewhat oily in appearance.

In selecting eggs remember that the color of the egg whether light or brown does not make any difference in its food value. The brown shelled egg is no richer than the white shelled ones.

Since the white of egg is albumen in the purest form and albumen coagulates at a temperature of from 134° to 160°F eggs or dishes in which they form a prominent part should not be cooked at a higher temperature than 160°F. A general rule to be remembered in the cooking of eggs is that eggs require a low temperature, a high temperature as in boiling water making the white tough and horny and if it is continued for some time a slight odor of hydrogen sulphid will be detected.

In our laboratory work in the testing of eggs to find the temperature at which coagulation occurs we used a test tube, this with its contents was immersed in water and the temperature of the water as well as of the contents of the tube was recorded. The following results were obtained.

Tests with white-

Begins to coagulate at 60°C. Water temperature 67°.

Is entirely coagulated at 79°C. Water-temperature 85°C.

Yolk.

Begins to coagulate at 50°C. Temperature of water 58°C.

Is entirely coagulated at 75°C. Temperature of water 85°C.

In cooking, eggs are used either alone or in combination. One of the most common methods of cooking them by themselves is the so called "boiling", which means that they are cooked in their shells in hot water, either by the cold water method which is putting them on in cold water and allowing it to reach a temperature of 175° - 180° F then removing from stove, or by the hot water method of pouring the boiling water over the eggs then setting them aside in a warm place for from 8 to 10 minutes. They are often sauted, fried in a little fat or dropped into hot water, milk or fat. They are somewhat less often shirred or baked but are good and probably more digestible than when cooked in any of the other ways except "boiling". Omelets of eggs alone are thought to be much better, because lighter, than those to which milk or flour is added. Scrambling is a palatable way of cooking them but some cooks term them "a spoiled omelet."

When used in combination with other things as in the making of cakes and custards the eggs serve a double purpose. They greatly increase the food value of the combination, and in some cases thicken the mixture and bind its parts together while in other cases they are used to leaven the whole. The whites of eggs(those eight hours old beat up best) are beaten very light and made to incase as much air as possible. This when added to the other ingredients makes the whole mixture porous and when heat is applied it hardens the walls of the air cells and the result is a light cake or bread.

"The digestibility of eggs depends largely upon the form in which they are taken.

2 eggs lightly boiled have left the stomach in 1 3/4 hours.

2 eggs raw have left the stomach in 2 1/4 hours.

2 eggs poached + 5 gms butter have left the stomach in 2 1/2 hours.

2 eggs hard boiled have left the stomach in 3 hours.

2 eggs as an omelet have left the stomach in 3 hours.

Raw eggs seem to be but little digested in the stomach and are passed on but little changed. This is probably due to their smoothness; they do not excite a flow of gastric juice neither do they cause a motion in the stomach. They are less irritating to the stomach and make little demand upon it and are in the end almost wholly digested; the digestion taking place in the intestines.

The hard cooked eggs will probably digest as easily as the soft egg if the former is finely chopped. "The white of one egg finely chopped and mixed with two and one half ounces of water remains in the stomach 1 1/4 hours." The yolk probably takes longer time to digest as it is heavier.

Eggs are almost completely absorbed in the intestines; a very small amount of waste being left. To this fact and also to the large amount of lime present is probably due the constipating effect of eggs upon some people.

The Minnesota Experiment Station Bulletin on the digestibility of eggs shows that while the method of cooking affects the rate of digestion it does not affect the digestibility.

Because of the proteid, mineral salts and fat contained by eggs their food value is very high. Comparisons have been made between the nutritive value of eggs and that of other foods. One egg yields 70 calories of energy and is equal in value to 1/2 tumbler of milk or 1 1/2 oz of fat meat. From 15 to 20 eggs are equal to two pounds of medium fat meat.

Price per pound 10 cents will purchase.

		Protein	Energy.
Eggs	16 cents	.083 lb.	400 calories.

	Price per pound	10 cents will purchase.	
Whole milk	3 cents	Protein	Energy.
		.110 lb.	1080 calories.

A dozen eggs weighing about 1 1/2 lbs would furnish .13 of a pound of protein and 640 calories which is nearly as much protein but only about 2/3 as much energy as a pound of medium fat beef shoulder which would cost 10 cents, while a pound of white bread would supply 0.18 lbs protein and 2400 calories.

The cost of fresh eggs varies with seasons and localities. At 15 and 20 and 25 cents a dozen they are a comparatively cheap food but at higher prices their nutrients are dear. Their usefulness in general cooking and the ease with which they may be prepared make them almost indespensible to the ordinary diet.

Since we know the chemical composition of egg and special value to use of the different substances contained we will receive egg substitutes with suspicion more especially those whose composition is not known. One substitute has been made from skim milk and is said to contain the casein and albumen of the milk mixed with a little flour. This, though rich in protein, is lacking in the fats and, for use with diabetic patients, the flour would be very harmful. Many of the egg substitutes have been made as nearly as possible to resemble eggs in their chemical ingredients while others are merely made to look like eggs and to answer somewhat the same purposes in cooking but while they may not be unwholesome they cannot take the place of eggs.

Eggs occupy a very important place in the diet not merely because of the value of its proteid and fat, for they are not a cheap source of either, but because to us the value of eggs as food does not lie alone in the

number of calories they will furnish but in the fact that they are convenient, and easily cooked, palatable and can be served in so many pleasing ways. We know that a food that is or can be made pleasing to the palate and attractive to the eyes digests much more readily and creates a desire for the proper amount needed by our bodies. In most families eggs and the foods into which they enter are favorite articles of diet.

But if the eggs are of so much value to well persons they are doubly valuable in the diet of the sick.

They are a valuable substitute for meat, being fairly rich in fats and proteid and are well adapted to the stomach of an invalid or convalescent when meats cannot be borne. The large amount of iron contained in the yolk make it useful to anaemic persons while the richness of the yolk in fats, lime salts and in organic compounds of iron and phosphorus make it specially valuable for young children and those having rickets. Convalescents, consumptives and anaemics can take from 6 to 8 eggs daily.

The advantages of the use of eggs in the sick-room may be summarized as follows-

Advantages

1 Their high nutritive value.

2 Their agreeable taste.

3 Their digestibility.

4 Their aseptic conditions.

5 Their deficiency in uric acid derivatives.

6 Their high content of lime(calcium) iron and phosphorus in organic combination(minerals in organic combination are more easily absorbed than when combined otherwise)

7 Their emulsified fat.

In some forms of sickness where solid food cannot be taken - eggs because of their high nutritive value will repair the muscular waste and keep up the energy. In diabetes eggs are much used though there is an argument against their use there because of the small carbohydrate element but since scientists cannot be certain as it is present they may well remain one of the standard articles of a diabetic's dietary.

With some people eggs acts as a poison and makes them very sick. Though this is usually made light of yet it remains a fact. The digestive juices of such persons seem to make poison from the egg. In some cases Hydrogen sulphide is formed during digestion in such cases the white of the egg should be avoided.